

CLAIMS

1. Camshaft adjuster (1, 1') for adjusting and fixing a position of the angle of rotation of a camshaft (8) relative to a crankshaft of a reciprocating-piston internal-combustion engine, comprising a high transmission and friction-reduced adjusting gear mechanism (2) comprising a drive shaft rotationally fixed to the crankshaft, a driven shaft rotationally fixed to the camshaft (8), and an adjusting shaft (9) connected to an adjusting motor shaft (10) of an adjusting motor, characterized in that the adjusting gear mechanism (2) and the adjusting motor (3) are formed as separate units and are connected to each other by a rotational backlash-free, disengaging coupling (4, 4', 4"; 32, 32'; 46; 51).
2. Camshaft adjuster according to Claim 1, characterized in that the adjusting motor is preferably an electric adjusting motor (3).
3. Camshaft adjuster according to Claim 2, characterized in that the coupling (4, 4', 4"; 32, 32'; 46, 51) has two parts, which can be joined together and of which one is rotationally fixed to the adjusting motor shaft (10) and the other is rotationally fixed to the adjusting shaft (9) or are formed integrally with the shafts (9, 10).
4. Camshaft adjuster according to Claim 3, characterized in that one of the two parts is formed as the outer part (19, 19'; 33, 33') and the other is formed as the inner part (18, 18'; 34, 34'), wherein the two parts can be inserted one into the other in a rotational backlash-free way.

5. Camshaft adjuster according to Claim 4, characterized in that the coupling
is formed as a profiled shaft coupling, preferably as a two-side shaft
coupling (4, 4', 4''), which has two coupling surfaces (21, 21') on the outer
part (19, 19') and two coupling surfaces (20, 20') on the inner part (18, 18'),
5 wherein preferably rotational backlash-reducing means are provided on the
latter.

6. Camshaft adjuster according to Claim 5, characterized in that a minimal,
tightly toleranced play is provided as rotational backlash-reducing means
10 between the coupling surfaces (20, 21) of the inner and outer parts (18, 19).

7. Camshaft adjuster according to Claim 5, characterized in that biased metal
or plastic springs, which bridge the play between the coupling surfaces (20',
21'), are provided as rotational backlash-reducing means.

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8. Camshaft adjuster according to Claim 7, characterized in that the metal
springs are preferably formed as flat bending or plate springs (23) and the
plastic springs are preferably formed as a polymer band (28) or as a polymer
O-ring (29) and are preferably arranged in grooves (22) or a circular groove
20 (30, 31) of the coupling surfaces (20') of the inner part (18').

9. Camshaft adjuster according to Claim 8, characterized in that the flat
bending or plate springs (23) are formed as one-piece spring clasps (25),
which preferably engage at corners (26) of the inner part (18').

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10. Camshaft adjuster according to Claim 4, characterized in that the
coupling is formed as a tubular shaft coupling (32, 32') comprising a hollow

cylindrical outer part (33, 33') and a coaxial, cylindrical inner part (34, 34'), which is arranged with play in the outer part (33, 33') and which preferably has the rotational backlash-reducing means.

5 11. Camshaft adjuster according to Claim 10, characterized in that an elastically deformable, preferably metal tolerance ring (44) is provided as the rotational backlash-reducing means, which is arranged in a radial groove (45) preferably on the periphery of the coaxial, cylindrical inner part (34') and projects beyond this groove by a certain extent in the radial direction.

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12. Camshaft adjuster according to Claim 10, characterized in that at least one locking ball (37) or one preferably cylindrical locking pin (41) with a conical end (42) is provided as rotational backlash-reducing means, which are guided in radial or through bore holes (35, 39) preferably of the coaxial, cylindrical inner part (34) with play and which can be moved into other radial bore holes (38, 38') of smaller diameter, which are aligned with the bore holes mentioned above, in the hollow cylindrical outer part (33) under the force of a compression or through spring (36, 36'; 40, 40') by an extent limited by the smaller diameter.

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13. Camshaft adjuster according to Claim 12, characterized in that the other radial bore holes (38, 38') are formed as elongated holes aligned in the axial direction.

25 14. Camshaft adjuster according to Claim 3, characterized in that the coupling is formed as a clutch coupling (46), whose two parts have axial claws (47, 48), which are arranged at the same diameter and which engage in

each other, wherein between the claws (47, 48) there are spaces, which are bridged in a rotational backlash-free way by tooth elements (50) of an elastic, biased polymer collar (49).

- 5 15. Camshaft adjuster according to Claim 4, characterized in that the coupling is formed as a profiled shaft coupling, preferably as a toothed shaft coupling, whose outer or inner part (55, 65), especially whose internal or external gearing (56, 63), is formed from elastic plastic.
- 10 16. Camshaft adjuster according to Claim 15, characterized in that the plastic external gearing (56, 63) is preferably molded directly on corresponding parts of the toothed shaft coupling or on a correspondingly formed, metallic intermediate bushing (58) and that the intermediate bushing (58) is connected to the toothed shaft coupling preferably by a force-fit connection.
- 15 17. Camshaft adjuster according to Claim 3, characterized in that the coupling is formed as a magnetic shaft coupling (51), whose two parts have opposing permanent magnets (52, 53), which transfer the driving moment of the adjusting motor (3) through magnetic forces in a contact-less and
- 20 18. Camshaft adjuster according to Claim 17, characterized in that the permanent magnets (52, 53) are preferably arranged in the axial direction and that between the magnets there is a non-magnetic membrane (54) with two-sided play, which seals the adjusting motor (3) in an oil-tight manner.